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The Patent Office

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Form 1/77

Patents Act 1977

1 Title of invention

1 Please give the title of the invention

FIRE RESISTANT TEXTILE MATERIAL

2 Applicant's details

☐ First or only applicant

2a If you are applying as a corporate body please give:

Corporate name
A W HAINSWORTH & SONS LTD

Country *(and State of incorporation, if appropriate)*
GREAT BRITAIN

2b If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

2c **In all cases,** please give the following details:

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(if applicable)

Country GREAT BRITAIN

ADP number
(if known)

4 Reference number

4 Agent's or applicant's reference number *(if applicable)* RFB/P17547

5 Claiming an earlier application date

5 Are you claiming that this application be treated as having been filed on the date of filing of an earlier application?

Please mark correct box

Yes ☐ No ☒ ➡ *go to 6*

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15(4) (Divisional) ☒ 8(3) ☐ 12(6) ☐ 37(4) ☐

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Country of filing	Priority application number *(if known)*	Filing date *(day,month,year)*

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FIRE RESISTANT TEXTILE MATERIAL

This invention relates to fire resistant textile materials and garments made from these materials. The invention relates particularly but not exclusively to articles of clothing for use by fire fighters and for textiles for manufacture of such clothing.

European legislation requires employers to provide garments which protect their employees against hazards to which they may be exposed. Clothing for protection against heat and flame must pass minimum performance requirements for flame, radiant heat, heat resistance, tensile and tear strength, abrasion resistance and penetration by water and liquid chemicals. The assembled garments must achieve levels of heat transfer by both flame and radiant heat.

One of the most effective ways to reduce second and third degree burns is to make sure that the barrier of protective clothing between the heat source and the skin remains intact during exposure. This is referred to as the "break open resistance" or "non-break open protection".

An object of the present invention is to optimise break open resistance. We have discovered that this can be achieved through use of enhanced fabrics design and fibre utilisation.

Outer textile materials for fire fighting clothing have previously been manufactured from 100% meta-aramid or polyamideimide, blends of meta-aramid and para-aramid fibres or by use of core spun yarns with polyparaphenylene terephthalamide copolymer or fibres comprising para-aramid cores with meta-aramid or polyamideimide covers. The combination of these fibres in the fabric enhances the "non-break open" protection of the product. However meta-aramid and polyamideimide fibres shrink, consolidate and thicken when exposed to a high temperature heat source. The presence of para-aramid or polyphenylene terephthalamide copolymer in either the fibre blend or as a core can be used to prevent fibre shrinkage and consequent breaking open of the garment. However the inclusion of para-aramid fibre in the blend has been found to be insufficient

improved textile materials for manufacture of fire fighting garments and the like.

Fire fighting garments have been made from a plurality of textile layers, comprising an outer layer of woven meta-aramid fibre, for example as manufactured under the trade mark Nomex. Break open protection may be afforded by blending with para-aramid fibres, eg as manufactured under the trade mark Kevlar and as disclosed in US 3063966 and 3506990. However charring of such blends may lead to cracking and embrittlement with consequent deterioration of physical properties.

According to the present invention a fire resistant textile material comprises a woven face fabric composed of fibres selected from meta-aramid, polyamideimide and mixtures thereof, the fabric including a woven mesh of strengthening fibres selected from para-aramid, polyparaphenylene terephthalamide copolymer and mixtures thereof.

Use of strengthening fibres in accordance with the present invention increases the residual tensile strength of the textile material following exposure to flame or a radiant heat source.

The strengthening fibres are preferably disposed behind the face fabric. This minimises exposure of the strengthening fibres to the heat source.

In preferred embodiments of the invention the strengthening fibres form an interwoven backing scrim on the face fabric. The strengthening fibres preferably comprise Kevlar yarns. The thickness of the yarn may be selected in accordance with the resultant mass and weave of the finished fabric. The resultant mass (g/m^2) will vary dependent on the particular end use but will generally be within the range 150 to 300 g/m^2. The woven fabric is preferably a combination of a face weave into which fabric is interwoven using a backing scrim. The face weave may vary dependent upon the mass and end use required. The interweaving of the backing scrim will be dependent on the face weave used.

Previously known fire fighting garments comprise a composite of three textile layers. The present invention reduces the need for use of three layers. Only two layers may be employed. For example a gabardine outer layer may be used to impart water resistance. This can be achieved because the dimensional stability of the outer layer is enhanced by use of the woven web of strengthening fibres.

The invention is further described by means of example but not in any limitative sense with reference to the accompanying drawing, Figure 1 which comprises a weaving specification for a textile material in accordance with this invention.

Test Method

The fire resistance of textile materials in accordance with the present invention was determined using the following test method.

The residual tensile strength of the outer shell material is tested in accordance with ISO 5081 after pretreatment of the complete assembly by EN366 Method A at a heat flux density of 40 kW/m^2 . This heat flux represents that to which a fire fighter may be exposed under emergency conditions.

Typical results of exposed fabric are:

FABRIC	RESIDUAL TENSILE STRENGTH (N)	
	WARP	WEFT
Hainsworth Quality EX276		
Nomex® Delta C 220 g/m^2		
Nomex® Delta T 220 g/m^2		
Nomex® Delta Z200 220 g/m^2		
Kermel HTA 220 g/m^2		
Pbi Gold (60% Kevlar® 40% PBI) 205 g/m^2		

Example 1

A textile material in accordance with the present invention was woven using the following specification EX276 illustrated in Figure 1. This fabric is a self-stitched double construction, with a twill face and a plain back. It is woven in the proportion of 6 face threads to one back thread.

3.3.99 EX 276 005/005

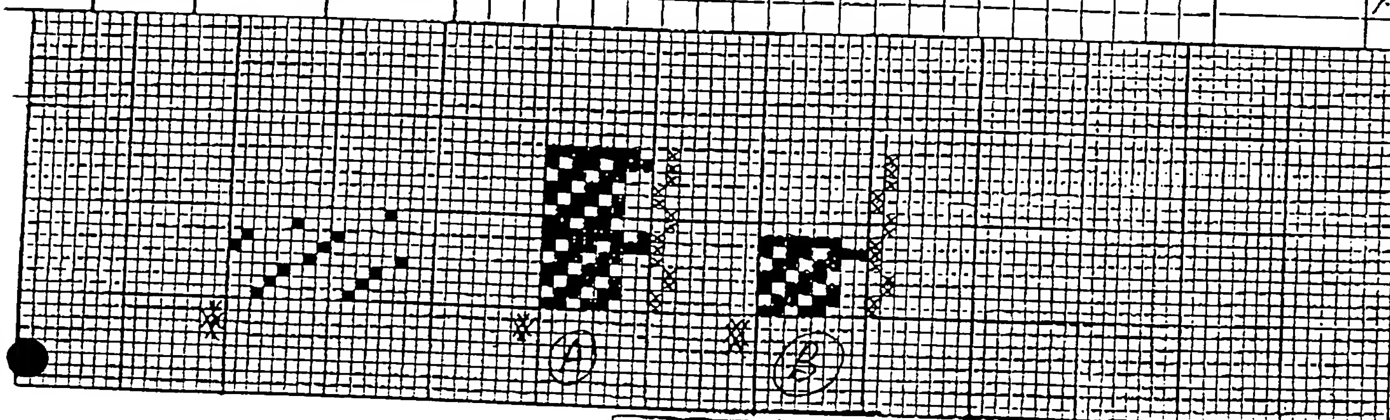
160 cms.

Count			Shade		Ends	Weight
1M	NOMEX	DELTA C	PARIS BLUE	5 6 4 } 5337 + 56 EDGES	5393	17.49 KGS
1M	KEVLAR		NATURAL	1 1 · (76)		1.44 KGS

Edge				
1M 60/2	NOMEX	DELTA C	PARIS BLUE	SOLID 28 ENDS EACH SIDE REPP ON EDGE SHAFTS SLEY 2'S

Warp No.	
Cuts	
Length	110. MTRS
Total Ends	5393
Sett	78.75 EPI *
Reed Width	69"
Plan	8 SHAFTS [illegible]
Picks/"	82

Weft					
1M 60/2	NOMEX	DELTA C	PARIS BLUE	6 } 7	17.92 KGS
1M 120/2	KEVLAR		NATURAL	1	1.49 KGS



MUST BE 82 PICKS PER INCH FULL UP AT FELL.

Piece Numbers		

* 22.5 REED SLEY 3, 4

[signature]